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Fixed Tank Systems for Type II and III Helicopters

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Background

Helicopter fixed tank suppressant systems have been used successfully for over 25 years. Fixed tanks are externally attached underneath the helicopter. Systems for use with a variety of helicopter models exist today with features such as foam injection and hover refill capability. Tanks can be filled either on the ground by hydrant, with snorkel fill from shallow natural sources or from open top dip tanks. Water, foam or approved long term retardants can be used with fixed tanks.

Operational Considerations

Fixed tanks are noted for being well suited for use with brush and grassland wildfires, but can also be used for building line and in timber areas. There is no oscillation with a fixed tank, which contributes to accurate drops. Fixed tanks typically are capable of split drops, and the type of drop can be varied by controlling the drop doors and airspeed. When choosing a landing site for a helicopter with a fixed tank installed, pilots must consider the reduced ground clearance. If there is sufficient space, the pilot can hover using in ground effect (IGE) power when flying with a fixed tank installed. Tanks are fairly easy to remove, and there is no problem in meeting the five minute removal requirement. However, fixed tanks can be difficult to install, especially without ground handling wheels. Most tanks require three or four people to hold in position and install. Unless there is provision for access to the cargo hook, a tank must be removed to use the aircraft cargo hook.

Summarized USDA Forest Service Contract Requirements

At present, the USDA Forest Service contract requirements for fixed suppressant/retardant delivery tanks for use with Type II or Type III helicopters include:

- The maximum gross weight of the tank (filled with suppressant) must not exceed the maximum rated lifting capability of the helicopter at sea level on a standard day.
- The empty tank weight is not to exceed 12.5% of the weight of the water capacity of the tank.
- The tank must be able to be removed from the aircraft in five minutes or less.
- If equipped with hover fill, the fill time is not to exceed 90 seconds.
- The ground fill port must be a three-inch Kamlock fitting located on the right side of the aircraft.
- Tanks are to be equipped with an independent emergency dump system which can allow the entire load to be dropped in six seconds or less.
- There are additional requirements for controls, doors, venting, and construction quality.

Manufacturers

At this time four manufacturers, Conair Aviation Ltd., Isolair, Sheetcraft, and Simplex Manufacturing Co., are known to be marketing helicopter fixed tank systems for Type II and Type III helicopters. Specifications and performance claims for each model included in this Tech Tips were provided by the manufacturers, and have not been independently tested or verified by the Center. Because prices for the systems can vary significantly, it is recommended to obtain current prices and system features by contacting the manufacturers.

Conair Aviation Ltd.

Conair Aviation Ltd. manufactures helicopter tank suppressant delivery systems for the Bell Model 205A-1/212, Bell 206L3/L4 and Eurocopter AS350 and SA315B helicopters. Conair's tank systems are certified for operations in a variety of countries. The AS350 system and the B205A-1/212 system are certified in both the Restricted and Transport Categories for rotocraft of the Federal Aviation Regulations. The AS350 system is available with a FAA Supplemental Type Certificate (STC) in both categories. The other systems can be provided with a STC.

The tanks are constructed of aluminum with fiberglass fairings. Installation of the tanks requires that the aircraft be equipped with standard high skid landing gear. For added ground clearance with the Bell 205A-1/212, Conair provides modified aft saddle fittings that are approved for use with the Bell high gear. In addition, both the B205A-1/212 and the B206L3/L4 tank systems have internal opening doors that provide greater clearance for maintenance and for when landing with the doors open following actuation of the emergency load release system. All of the tanks can be removed by four people in five minutes or less.

The tanks are each equipped with two electrically controlled hydraulic actuated doors that may be operated independently or in tandem by depressing a button on the cyclic. Each tank is equipped with a mechanical emergency load release system to allow the pilot to jettison the load following failure of the main door control system. Drop type selection and systems status information using annunciators are provided by the cockpit control panel. Control and status indication of the auxiliary hydraulic system is also provided by switches, annunciators and gauges housed in a cockpit console.

Each of the tank systems can be hover or ground filled. For hover filling, a water source must be at least one foot deep. The hover fill pumps are hydraulically powered using auxiliary hydraulic systems that are independent of aircraft systems. A pneumatically powered hover fill system is also under investigation by Conair.

Options available for the Bell 205/212 model include:

- an aft door load release system for filling portable ground reservoirs when hovering in ground effect

- an off-load pump system for filling portable ground reservoirs when hovering in ground effect
- a variable flow control (VFC) system allowing variable door positions to achieve different discharge flow rates

Foam injection is available for all tank systems. With the exception of the B205A-1/212 system, the foam injection tank and pumping components are integral with the fixed tank. The B205A-1/212 foam injection system is installed in the aft section of the helicopter cabin. A quick-disconnect hose transfers the concentrate from the aircraft to the fixed tank.

With the exception of the Bell 205 tank with optional cargo hook installation, cargo hooks are not accessible with the tanks installed.

A Bell 212 helicopter equipped with a Conair tank is shown making a drop in Figure 1.



Figure 1. Bell 212 helicopter with a Conair Tank.

Specifications for the Conair helicopter tanks are shown in Table 1.

Table 1. Specifications of Conair helicopter tank systems.

Helicopter Model	Bell 205A-1/212	Bell 206L3/L4	Eurocopter AS350	Eurocopter SA315B
Tank: Height	15-in (.38 m)	14.4-in (.366 m)	doors closed: 14-in (.36 m) doors open: 21-in (.53 m)	doors closed: 15.5-in (.394 m) doors open: 21-in (.53 m)
Width	61.5-in (1.56 m)	50.0-in (1.27 m)	55.1-in (1.40 m)	50.0-in (1.27 m)
Length	176-in (4.47 m)	66.5-in (1.69 m)	119-in (3.02 m)	141-in (3.58 m)
Net weight	582 lb (264 kg) without options	254 lb (115 kg)	441 lb (200 kg)	320 lb (145 kg)
Net weight with options	683 lb (310 kg)	N/A	N/A	N/A
Gross weight with options (max.)	3677 lb (1668 kg)			
Water capacity	359 US gal (1360 L)	159 US gal (600 L)	211 US gal (800 L)	238 US gal (900 L)
Foam concentrate capacity	54.2 US gal (205 L)	6.6 US gal (25 L)	20 US gal (75 L)	21 US gal (80 L)
Hover fill rate (max.)	430 gpm (1630 L/m)	238 gpm (900L/m)*	430 gpm (1630 L/m)	408 gpm (1543 L/m)
Hover fill time, (approx. field avgs.)	50 sec	40 sec*	35 sec	35 to 40 sec

* Estimated using the pneumatic hover fill system. Hover fill system not available at present.

¹ Basic configuration without options includes: 1360 L tank, new aft landing gear saddle fittings, hover-fill system, auxiliary hydraulic system, emergency load release system.

² Configuration with options includes these additional items in addition to the basic items listed above: VFC system, aft door, off-load system, quantity measuring system, foam injection system, dual mirror kit, 2000 lb (900 kg) cargo hook system.

Isolair

In the Type II and Type III category, Isolair Eliminator II fixed tank systems are available for the Bell 206B and 206L series, 204, 205, 212, 412 and 214, and the Eurocopter 350 series of helicopters. Isolair tanks are primarily constructed of fiberglass. Some of the systems have received FAA Supplemental Type Certification.

The systems are currently being modified with the addition of ground handling wheels which will allow one person installation. Cargo hooks are still accessible for emergency use with the system in place.

All of the tank systems can be hover filled from a water source that is at least one foot deep, or the tanks can be ground filled. The hover probe contains a pump at the lower end of the assembly. The refill pump is driven by an electric motor, and requires 24VDC and 90 Amps. For the 204, 205, and 212/412 models, electric power is taken from an added non-essential bus, and for the Astar tanks electric power is pulled from the aircraft main bus and is circuit protected. An optional hydraulic driven pump is available only for the military version of the Bell 205/212 ships.

With the exception of the smallest model for the 206B series, all tanks have split doors for flexibility in drop pattern and volume control. Dump doors are hydraulically actuated and individually controllable. Separate foam concentrate storage is contained within the tank, and the pilot can control the mix ratio. Drop length is also pilot controllable for a given airspeed.

Each system enables the pilot to control hover loading, foam mix ratios, dump volume and drop length. Emergency dump, primary dump, hover refill pump initiate, and foam pump initiate switches are located on the cyclic. The display box houses the foam injection timer, percent of foam concentrate and door select switches. Enunciators on the display box detail quantity of water and foam concentrate, door close position, foam timer sequence operation, and condition of hover refill pump such as overheat and proper connection.

Specifications for some of the Isolair tank systems are shown in Table 2.

Table 2. Specifications for selected Isolair fixed tank systems.

Tank Model	4600-206L-3	4600-350	4600-350B2	4600-205
Helicopter	Bell 206L-3	Eurocopter 350	Eurocopter 350B2	Bell 205
Tank: Height	14-in (.36 m)	15-in (.38 m)	13-in (.33 m)	14-in (.36 m)
Width	48-in (1.2 m)	49-in (1.2 m)	52-in (1.3 m)	88-in (2.2 m)
Length	77-in (2.0 m)	97-in (2.5 m)	96-in (2.4 m)	90-in (2.3 m)
Net weight	184 lb (83.5 kg)	247 lb (112 kg)	247 lb (112 kg)	336 lb (152 kg)
Gross weight	1486 lb (674 kg)	1898 lb (861 kg)	2693 lb (1222 kg)	3260 lb (1480 kg)
Water capacity	146 US gal (553 L)	198 US gal (750 L)	270 US gal (1020 L)	351 US gal (1330 L)
Foam concentrate capacity	10 US gal (38 L)	15 US gal (57 L)	15 US gal (57 L)	27 US gal (102 L)
Hover fill rate, max. with electric pump	350 gpm (1320 L/m)	400 gpm (1500 L/m)	400 gpm (1500 L/m)	400 gpm (1500 L/m)
Hover fill time	20 to 25 sec	25 to 30 sec	35 to 40 sec	55 to 75 sec

Sheetcraft

Sheetcraft's Skyhydrant fixed tank fire fighting systems are available for use with the Bell 205/212, Bell 214B/412, Bell 206B/206L3/204 and MD 500 series helicopters. Both Los Angeles County and City Fire Departments have been flying with the Sheetcraft 205/212 style tank for 25 years. FAA Supplemental Type Certification is pending for the 205/212 tank.

All of the tanks can be ground filled, and the 360 gallon capacity tank for the Bell 205/212 and 214B/412 helicopters have optional hover refill capability. The 360 gallon tank also has optional foam injection. A Sheetcraft 360 gallon tank installed on a LA County Fire helicopter is shown in Figure 2. The tank systems for the MD 500 and Bell 206B series helicopters have 125 gallons of capacity, and the 206L3 tank holds 150 gallons. All Sheetcraft tanks are fabricated of aluminum.



Figure 2. Sheetcraft tank on a LA County Fire Bell 412 helicopter.

The hover refill system for the Sheetcraft 360 gallon tank was developed with ERA Helicopters, and is hydraulically operated and interfaced with the helicopter electrical power system. The system can hover refill from water sources that are at least one foot deep.

System installation requires that the aircraft have standard high skid gear. The tank can be removed by three people in less than five minutes. The cargo hook remains installed, but not accessible with the tank in place. Water can be emergency released in less than three seconds.

System controls include door actuation (the two doors for the 360 gallon tank can be opened simultaneously or singularly), foam injection mix ratio, and emergency release. The operation selector panel is located on the console, and actuating switches are located on the collective. Door position indicator lights are located on the glare shield in front of the pilot, and a DOOR OPEN audible warning is located behind the pilot.

Specifications for the 360 gallon tank system are shown in Table 3.

*Table 3.
Specifications for Sheetcraft tank for Bell 205/212 and 2148/412 helicopters.*

Tank system height	17-in (.43 m)
Tank system width	96-in (2.4 m)
Tank system length	106-in (2.69 m)
Total system weight	337 lb (153 kg)
Water capacity	369 gal (US) (1400 L)
Electrical power required (for tank doors)	35 A maximum
Door actuation operating system	Electric/Pneumatic
Hover fill time	1 min 11 sec
Snorkel recommended duty cycle	1 min running time, then 3 min rest
Foam reservoir capacity	12.5 gal (10 to 15 drops) (47.3 L)

Simplex Manufacturing Co.

Simplex Fire Attack fixed tank systems for Type II and Type III helicopters are available for the Bell 206L series, Bell 205/212, Eurocopter AStar series, and the BK-117. FAA Supplemental Type Certification has been obtained for the Bell 205 model 10400 tank installation, and is pending for the Bell 212. The Bell 205/212 installation is shown in Figure 3.

The Fire Attack tanks are constructed of reinforced fiberglass. Each of the tank systems are equipped with built-in foam retardant tanks, and have hydraulically actuated dump door assemblies. Dump volume and drop length for a given airspeed, and foam/retardant ratio mixing are pilot controllable. Tanks can be installed and removed by a two person crew, and removal can be accomplished within five minutes.

All of the tank systems can be hover filled from a water source that is at least six inches deep, or the tanks can be ground filled. Hover refill pumps are either electrically or hydraulically driven depending on tank system model. Electric power is taken from the aircraft main electric bus, and hydraulic power for the



*Figure 3.
Simplex tank installation for Bell 205 and 212 helicopters.*

model 10400 (Bell 205/212) is taken from the helicopter transmission offset quill drive. Power requirements during filling are approximately 100 amps, 2.5 horsepower for the electric pumps and 8.5 hp for the hydraulic pump. Simplex is developing an electrical pump that will produce higher volume for the same amperage draw.

Each system includes an onboard micro-processor which controls the system based on pilot input. Total volume loaded, foam injection ratio, and door settings are input by the pilot, and then all operations are recorded on a data card from which data can be printed. Other recorded data includes total flight time, number of loads, water volume, foam consumed, and start/stop time.

A summary of Fire Attack models and specifications is shown in Table 4.

SUMMARY

A summary of the fixed tank systems from the four suppliers discussed in this Tech Tips and their respective features are provided in Table 5.

Table 4.
Specifications of Simplex Fire Attack Tank Systems.

Tank Model	10300	10400	10600	11000
Helicopter	Bell 206L, L1, L3	Bell 205, 212	Eurocopter AStar AS350B, C, D	Eurocopter BK117
Tank:				
Height	16 in (.41 m)	18 in (.46 m)	22 in (.56 m)	10 in (.25 m)
Width	57 in (1.4 m)	58 in (1.5 m)	49 in (1.2 m)	69 in (1.8 m)
Length	100 in (2.5 m)	144 in (3.66 m)	96 in (2.4 m)	106 in (2.69 m)
Net weight	290 lb (132 kg)	640 lb (290 kg)	290 lb (131 kg)	286 lb (130 kg)
Water capacity	155 US gal (587 L)	360 US gal (1360 L)	155 US gal (587 L)	211 US gal (800 L)
Foam concentrate capacity	14 US gal (53 L)	25 US gal (95 L)	20 US gal (76 L)	14 to 20 US gal (53 to 76 L)
Hover fill rate	120 gpm (450 L/m) 1 min 18 sec	380 gpm (1440 L/m) 57 sec	120 gpm (450 L/m) 1 min 18 sec	120 gpm (450 L/m) 1 min 46 sec
Snorkel pump power	Electric motor	Hydraulic motor	Electric motor	Electric motor

Table 5. Summary of Fixed Tank Systems.

Helicopter Model/Co. (tank empty weight), capacity, features	Conair	Isolair	Sheetcraft	Simplex
Bell 205/212, 214/412	582-683 lb ¹ (264-310 kg) H, Fm, C*, Al	336 lb (152 kg) H, Fm, C, Fbr	337 lb (153 kg) H, Fm, Al	640 lb (290 kg) H, Fm, Fbr
Bell 206L series	254 lb (115 kg) H, Fm, Al	184 lb (83.5 kg) H, Fm, C, Fbr	85 lb (39 kg) Al	290 lb (132 kg) H, Fm, Fbr
Eurocopter AS350 series	441 lb (200 kg) H, Fm, Fbr, Al	247 lb (112 kg) H, Fm, C, Fbr	N/A	290 lb (132 kg) H, Fm, Fbr
Eurocopter SA315	320 lb (145 kg) H, Fm, Al	N/A	N/A	N/A
Eurocopter BK117	N/A	N/A	N/A	286 lb (130 kg) H, Fm, Fbr
MD 500 Series	N/A	N/A	85 lb (39 kg) Al	N/A
			125 gal (473 L)	

* Has optional cargo hook attached to the tank.

¹ Tank Empty Weight.

² Tank Capacity.

³ Key for Features:

Has hover refill = H

Foam Injection = Fm

Cargo hook access = C

Primarily constructed of Aluminum = Al, Fiberglass = Fbr

ADDITIONAL INFORMATION

Current pricing and additional product information can be obtained from the manufacturers at the following addresses and telephone numbers.

Conair Aviation Ltd.

P.O. Box 220
Abbotsford, BC
Canada V2S 4N9
Tel: (604) 855-1171
Fax: (604) 855-1017

Isolair

20490 E. Aschoff Road
Rhododendron, OR 97049
Tel: (503) 622-3010
Fax: (503) 622-4274
Telex: 360966 RNLSECPTL

Sheetcraft

447 South Ojai
Santa Paula, CA 93060
Tel: 805-525-3942
Fax: 805-525-2598

Simplex Manufacturing Co.

13340 N.E. Whitaker Way
Portland, OR 97230
Tel: (503) 257-3511
Fax: (503) 257-8556
Telex: 279593 SIM UR

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